Technical Solution to Mitigate 800 MHz Interference

FCC Presentation

May 29, 2003

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Motorola Responds to FCC Inquiry

"Given the critical importance of these interference issues, I am writing to inquire…if you are aware of any practical, technical, or procedural solutions or information… that you believe we should consider…"

April 18 FCC Letter

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Technical Means to Address Interference

- May 6 Technical Response addresses interference
  - Outlines advances in receiver technology
  - Provides technical solution to interference
  - Applies solution to areas where interference is being experienced
- Technical solution combines receiver changes with Best Practices
  - Intermodulation Interference - Attenuation provides 3:1 improvement
  - Overload Interference - Attenuation improves overload performance
  - Out-of-Band Interference - filtering, adjusting relative power levels, frequency swaps and frequency planning
- Technical Solution:
  - Is non-proprietary
  - Addresses interference where it exists
  - Works equally well in border and non-border areas
  - Maintains interoperability
  - Is pro-active

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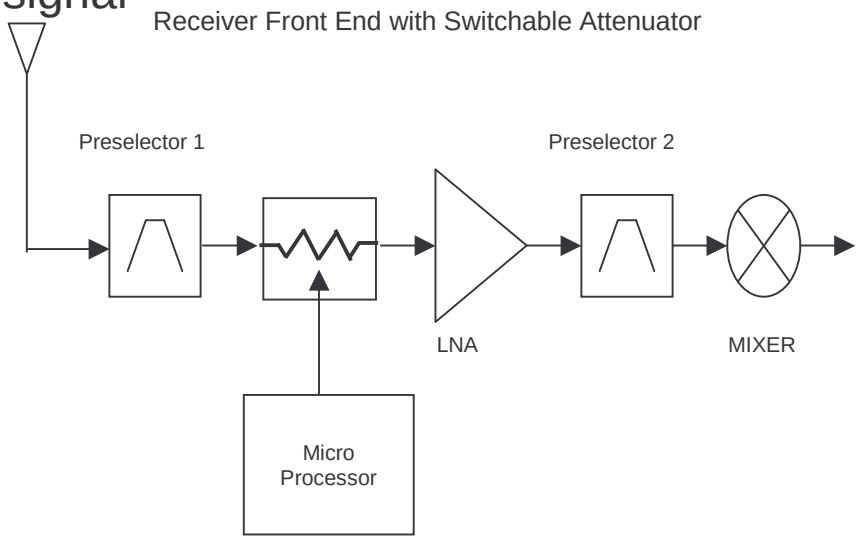
How Does a Switchable Attenuator Work?

- Attenuates all signals entering the radio front end
- Improves intermodulation rejection
  - Decreasing undesired signal 1dB provides 3 dB improvement in IM;
- Software controlled
  - Engages when sufficient desired signal
  - Disengages in weak signal areas
  - Transparent to user
- No negative impact on usable service area



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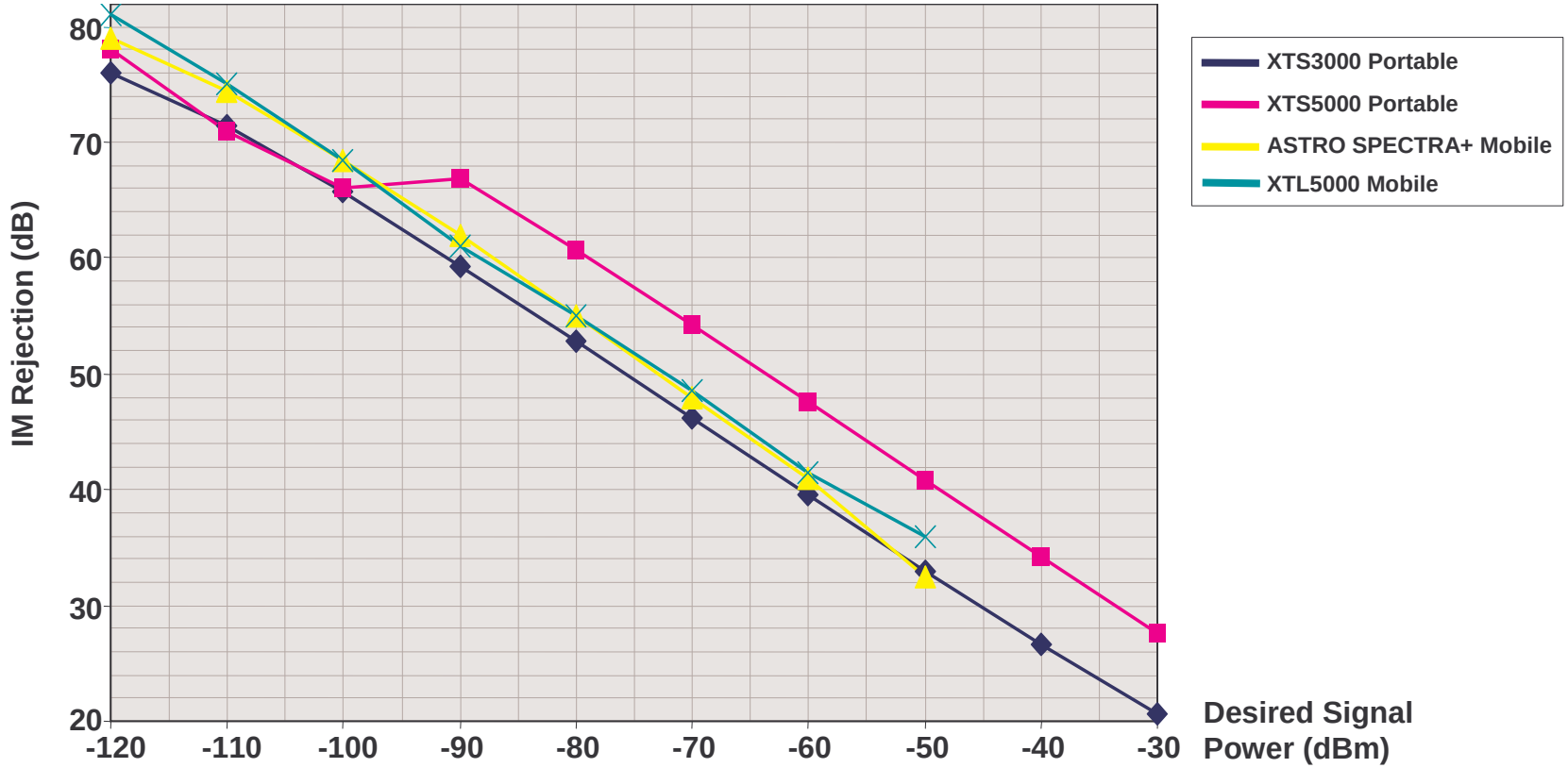
IM Rejection with Switchable Attenuator



- Portable IM rejection exceeds that of mobiles when step attenuator is used
- Motorola is not aware of IM interference from CMRS sites when mobile receivers meet the Class A level of performance.

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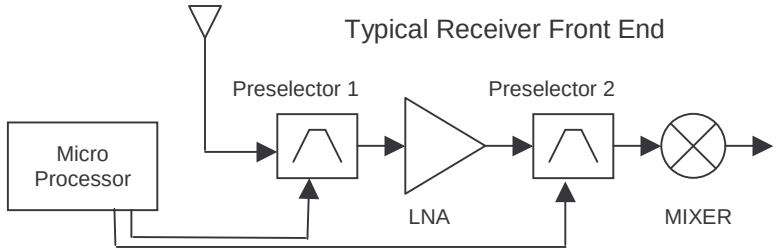
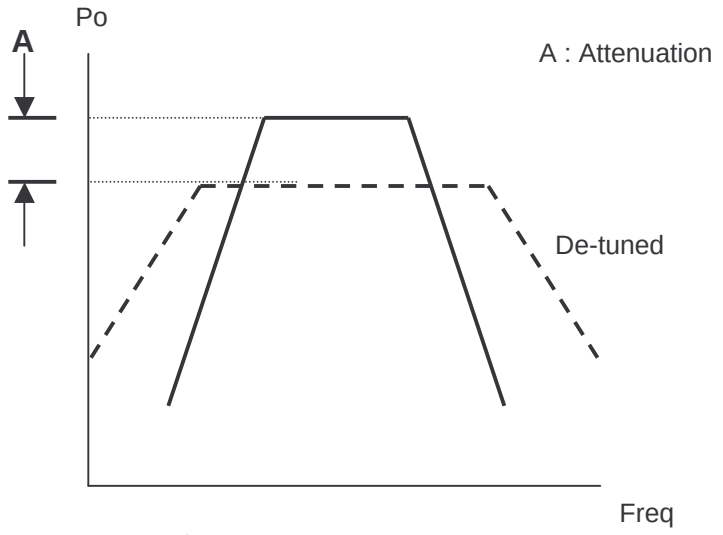
Front End Pre-Selector De-Tuning

- XTS2500 & XTS5000 7/800MHz Radios use Varactor Tuned Pre-selectors
  - Shipping since 4Q2001
- Front-end attenuation achievable by de-tuning varactors
  - Attenuates desired and undesired
  - Does not tighten filter passband
  - Does not pull in 3dB corner
- Software will be available in mid 2003
- Hardware attenuator will be added in 4Q 2003





Idealized characterization - all signals attenuated, real performance has variations

De-Tuning Attenuates Desired and Undesired Signals

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Status of Testing to Date

- Tested in 8 markets with interference
  - Anne Arundel County
  - Columbus, Ohio
  - Sacramento Fire Department
  - Phoenix/Mesa
  - Washington County
  - Las Vegas
  - Broward County
  - City of San Diego
- Testing conducted with no increase in signal level
- Interference mitigated
  - Radio performance significantly exceeds performance of current radios
- Beta testing being implemented
- Results are very encouraging

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Attenuator Implementation

- Switchable Attenuators do not Require Widespread Increase in Desired Signal
  - Most systems and areas do not experience interference - no changes needed.
  - Systems designed for portable coverage should already meet minimum required signal.
  - In the event increased desired signal is needed, users get the added benefit of improved coverage/building penetration
- Does not require immediate replacement of all public safety and private user portables.
  - Going forward, Motorola will include attenuators in all future 800 MHz radios at no incremental cost.
  - Licensees can implement interference mitigation technology through normal replacement cycles.
- Users with interference have several options, depending on situation:
  - Retrofit XTS 2500 and XTS 5000 through low cost software upgrade
  - Retrofit some other models through hardware modification.
  - Some radios may need to be replaced

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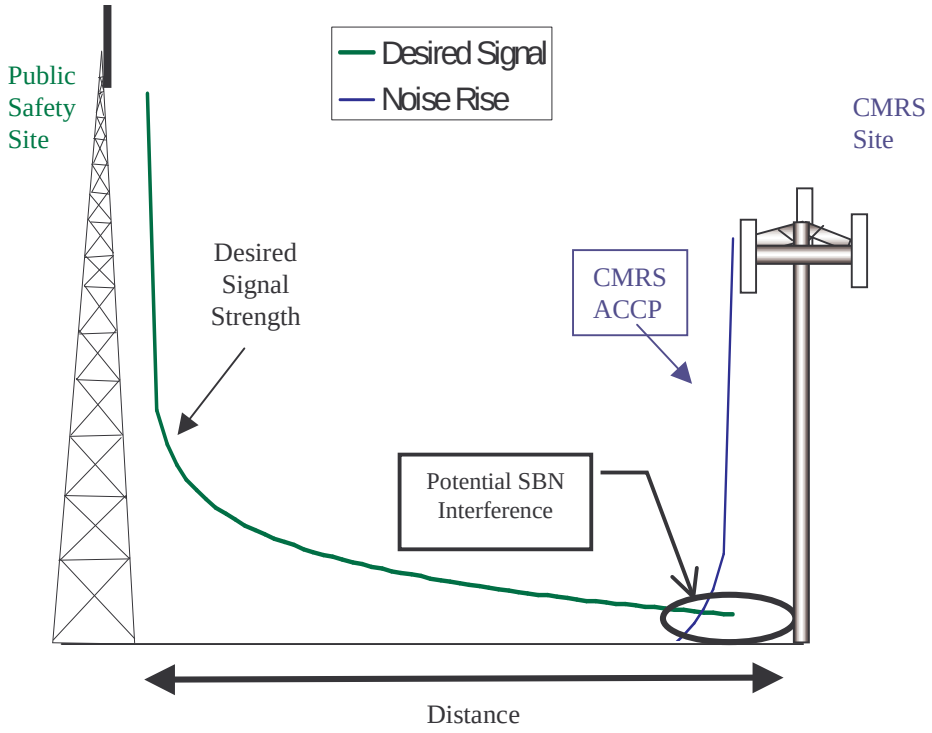
Out-Of-Band Emissions/Adjacent Channel Coupled Power



- Low CMRS sites may raise the noise floor in some areas
- Not a problem everywhere; depends on:
  - –Signals radiated from transmitter sites
    - Function of power, filtering, antenna patterns, local clutter
  - –PS signal strength
    - Noise floor rise can be tolerated where the PS signal is above threshold
  - – Frequencies of desired & undesired signals
    - Impact to a particular channel depends on frequency separation between desired signal and interferers

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Responding to Out-Of-Band Emissions

- Reducing OOBE at source
  - Add CMRS Transmit Filters
  - Modify CMRS radiation patterns to reduce ERP in certain areas
  - Change CMRS Frequencies
  - Increase CMRS Site Height
  - Reduce CMRS Transmit Powers
- Overcoming OOBE
  - Raise Desired Signal Level
  - Change Frequencies for Desired Signal
  - Add Site for Desired Signal (may address multiple interference cases)

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Summary

- Field testing shows technical solution is practical and mitigates interference.
- Technical solution uses non-proprietary techniques which multiple manufacturers can implement.
- Solution works equally well in border and non-border areas.
- Technical solution helps maintain interoperability.
- Technical solutions can be addressed with those users receiving interference.
- Most users can implement as part of their normal radio replacement cycle at no additional cost.

There is a technology toolbox that can mitigate interference.

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